INTRODUCTION

This module provides information about methods used to control the spread of radioactive contamination at the scene of a transportation incident involving radioactive material. The process for identification and hazard assessment at a hazardous material incident will be introduced along with the protective measures of time, distance, and shielding. This module also discusses the use of personal protective equipment as well as proper work practices used to help control radiological contamination. Crowd control is also an important segment discussed in this module.

PURPOSE

The purpose of this module is to help you understand the importance of donning the proper personal protective equipment, controlling contamination and maintaining crowd control. The information in this module will help you protect yourself and others from radioactive contamination at the scene of a transportation incident involving radioactive material.

MODULE OBJECTIVES

Upon completion of this module, you will be able to:

1. Identify the basic steps for identification and hazard assessment at the scene.
2. Identify ways to protect on-scene personnel from radiological contamination at the scene of a transportation incident involving radioactive material.
3. Identify the basic protection measures of time, distance, and shielding.
4. Identify ways to control the spread of contamination while taking defensive measures to limit impacts of an incident involving radioactive material.
5. Identify factors to consider when implementing public protective action and crowd control at the scene of a transportation incident involving radioactive material.

notes

notes

IDENTIFICATION AND HAZARD ASSESSMENT

At the scene of a transportation incident involving hazardous material, your initial assessment should include identification of the hazardous material(s), and the hazards associated with that material(s). This identification process is a crucial step in determining which personal protective actions to take in order to protect on-scene personnel. Identification of the hazardous material can be simple for one hazard, or complex for a combination of materials. For identification and hazard assessment at the scene, use the following five-step process:

1. **Identify the substance.**
   What is the substance or material (name of material)?
2. **Consider all potential hazards associated with the substance in question.**
   What are the physical hazards of the material?
3. **Assess physical and chemical properties.**
   What are the physical/chemical properties of the material (e.g., solid, liquid, gas, reactive)?
4. **Assess variables and modifiers.**
   What happens if the material is on fire, chemicals mix, or water is added?
5. **Assess behavior and outcomes.**
   What is the final outcome?

Any further action taken at an incident scene will be based upon how well the identification and hazard assessment was performed during the initial assessment.

PERSONAL PROTECTIVE EQUIPMENT

While conducting your Identification and Hazard Assessment, if you see or suspect that a package containing radioactive material might be damaged, the immediate incident area should be considered potentially contaminated. All personnel, equipment and material entering the area are at risk of becoming contaminated. To prevent contamination from spreading to personnel, all responders should use personal protective equipment (PPE).

The degree or level of PPE depends on radiological conditions, the presence of other hazardous material, the nature of the job, local standard operating procedures, and the level of training that each responder has received.

notes

notes

Typical PPE used during radiological incidents may consist of, but is not limited to, the following:

- Firefighter turnouts or bunker gear
- Respiratory protection, such as self-contained breathing apparatus (SCBA) or other approved respiratory protective equipment
- Disposable coveralls
- Shoe covers or boots
- Gloves
- Hoods
- Safety glasses

Note: If used properly, PPE will provide protection from radiological skin contamination. You should also carefully consider secondary hazards that may be present. Corrosive, toxic or other hazards may require additional PPE.

Proper use of PPE includes inspecting your PPE thoroughly prior to use. It is a good practice to tape around openings of protective clothing as an extra precaution. For example, tape gloves to turnout sleeves, tape zipper flaps, etc.

Protecting Equipment

Also take precautions to prevent equipment from becoming contaminated. Many items used during radiological operations—including survey meters—may not be able to be completely decontaminated, and are expensive to replace.

Simple measures you can take to protect equipment include:

- Placing meters and other instruments into plastic bags, then sealing the bags[1].
  Equipment can still be operated and meters read through the bags, but the potential for contamination is much less than when the instrument is left uncovered. The plastic can then be removed and disposed of when leaving the hot zone. The detector surface on some types of contamination survey instruments should be left uncovered so as not to shield the radiation/contamination you are trying to detect.
- Wrap tool handles and exposed surfaces with masking tape or duct tape. The tape can then be removed and disposed of as radioactive waste if it becomes contaminated.

[1] Note: this applies primarily to radiological survey meters. Not all types of meters should be sealed in plastic bags (e.g., oxygen meters, explosive meters, etc.).

notes

notes

PROTECTING PERSONNEL FROM RADIATION EXPOSURE

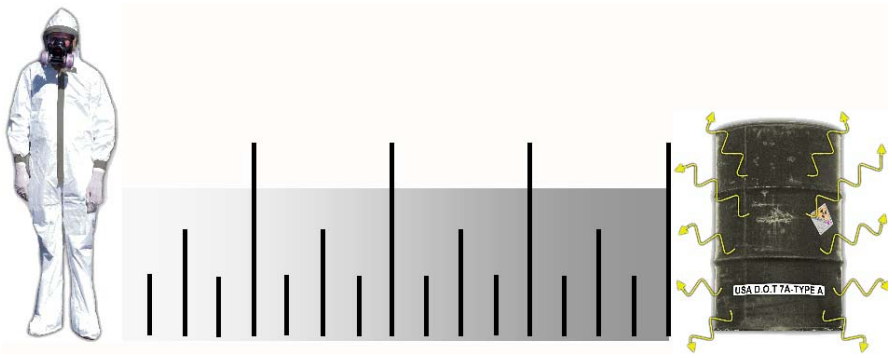
By implementing proper radiological controls at the scene of an incident involving radioactive material, personnel radiation exposure can be kept to a minimum. There are three radiation protection principles to follow to minimize the amount of external radiation exposure received at an incident involving radioactive material. These radiation protection principles involve the use of time, distance, and shielding.

Time

Minimizing time in a field of radiation is an important factor in radiation protection. The less time spent in a field of radiation, the less radiation exposure received. The longer a person remains in a radiation field, the greater their exposure. If personnel are available, a rotating team approach can be used to keep individual radiation exposures to a minimum.

Distance

Maximizing distance from a radiation source is an effective method for minimizing radiation exposure. Radiation dose rates decrease dramatically as you move away from the source. For example, if you double the distance from a source of radiation, the radiation dose rate falls to approximately one-fourth of its original value.

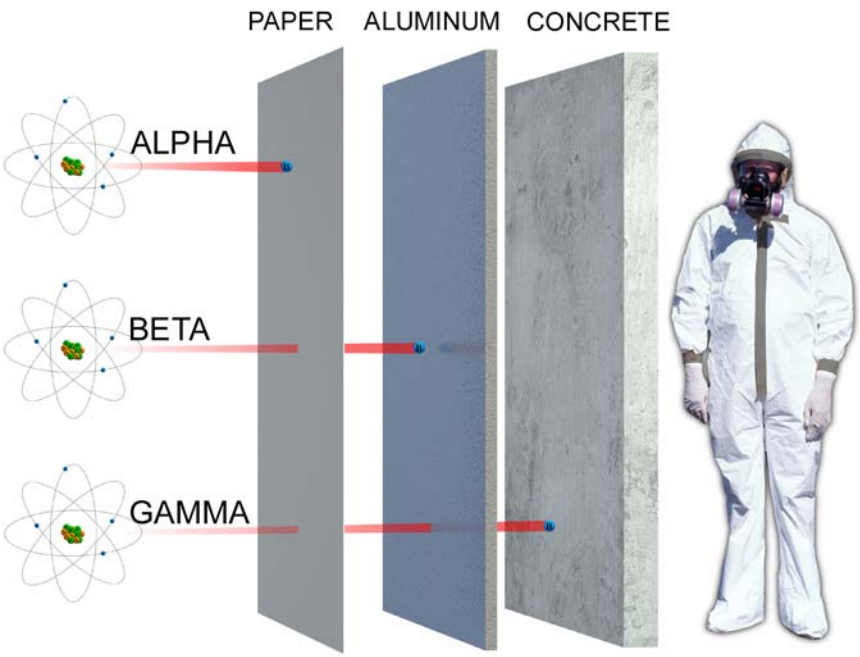


notes

Shielding

Shielding refers to material that absorbs or blocks radiation. Different materials are used to shield different types of radiation. Generally speaking, the denser the material, the greater its ability to protect you from radiation. A high-density material like lead is a highly effective radiation shield. Many objects, including vehicles, a mound of dirt, or a piece of heavy equipment, can be used as shields to diminish the exposure level in the working area if they are located between the responder and the radiation source. In many emergency situations, however, shielding is often limited to lightweight protective clothing such as gloves, shoe covers, standard fire turnout gear, and coats and jackets, or surgical clothing. These types of clothing will provide you with some limited protection against radiation.

Shielding is not always practical during emergency field operations and administering emergency care should never be delayed in the interest of seeking shielding materials. Rather, the factors of time and distance can be used to reduce radiation exposures to levels that are as low as can be reasonably expected.



notes

CONTROLLING RADIOLOGICAL CONTAMINATION

Always consider the potential for contamination at the scene of a radioactive material transportation incident. By controlling contamination, the potential for internal exposure and personnel contamination decreases. By following basic contamination control procedures, you can greatly reduce the chance of becoming contaminated.

Controlling the spread of contamination also reduces any potential environmental impacts that result from the release of radioactive material.

The greatest potential for contamination during a transportation incident involving radioactive material is from breached shipping package(s). Packaging requirements are strict enough that the package(s) will not generally release material, even when handled roughly. When radioactive material packaging is breached, the spilled contents may or may not be visible.

The presence of radioactive material in a fire creates additional concerns. If a package is on fire, consider the smoke and ash as contaminated until proven otherwise. Contaminated smoke and ash can spread contamination further than the initial incident, and airborne contamination if inhaled, can result in internal contamination.

Following standard operating procedures during any hazardous material incident or fire—including the use of respiratory protection (SCBA) when appropriate—will minimize the contamination potential at the incident scene, and prevent others from inhaling airborne radioactive material. Radioactive material does not change the effectiveness of standard fire control techniques. You should try to limit the amount of water used in firefighting, and attempt to contain any related runoff to avoid contaminating the surrounding environment.

notes

notes

METHODS FOR CONTROLLING RADIOLOGICAL CONTAMINATION

Responders at an incident scene involving radioactive material should take the following actions to help control the spread of contamination, thereby limiting the impacts of the incident.

- Secure the scene. Without entering the immediate hazard area, isolate the area and keep non-essential people away from the scene.
- Allow only qualified response personnel into the scene.
- Identify sources of contamination (breached packages, etc.) so they can be isolated.
- Extinguish fires. Fire can spread contamination.
- Dike any runoff water that may be contaminated.
- When entering potentially contaminated areas, wear appropriate PPE. Change out gloves and other protective gear as necessary to prevent cross-contamination of personnel or equipment.
- Bag or tape tools and equipment taken into the hot zone to prevent them from becoming contaminated.
- Limit what you take into the hot zone. Anything taken into the hot zone has the chance of becoming contaminated.
- Stay alert; watch for actions that may spread contamination outside the hot zone (e.g., personnel leaving the hot zone without removing protective clothing).
- Before exiting the hot zone, personnel should remove protective clothing and be surveyed for contamination by qualified personnel.

PUBLIC PROTECTIVE ACTIONS

Implementing public protective actions and crowd control at the scene of a transportation incident involving radioactive material are important considerations. Two key factors to consider when determining initial isolation and evacuation distances for public protection are:

- The size of the spill
- Whether or not the radioactive material is involved in a fire

Your state or local Radiation Authority should be notified in the event of an incident involving radioactive material, and is usually responsible for making radiological decisions. First-on-scene responders can use the guidance provided in the Emergency Response Guidebook (ERG) for public safety and initial isolation/evacuation distances at the incident scene.

For most spills/incidents involving radioactive material, the ERG recommends an initial isolation distance of 80 to 160 feet in all directions.

For large spills (more than 200 liters), the guides for radioactive material recommend initial downwind evacuation of 330 feet.

If a large quantity of radioactive material is involved in a major fire, the ERG recommends an initial evacuation distance of 1,000 feet in all directions.

Other considerations include providing control for all traffic at the scene, including pedestrians. In rural areas, it may be necessary to close down large stretches of highway in order to find alternate traffic routes that avoid the incident scene.

Uninjured persons suspected to be contaminated should be asked to remain in the area until surveyed by qualified personnel. Equipment that has entered the hot zone should not leave until surveyed for contamination by qualified personnel. Delay decontamination and cleanup activities until instructions are received from your Radiation Authority.

notes

Check Your Understanding

1. There are _____ steps in Identification and Hazard Assessment.

2. To protect on-scene personnel from radiological contamination _____ _____ _____ may be worn.

3. An effective way of protecting equipment from radiological contamination is to seal the equipment in a _____ ____.

4. Regarding PPE, which of the following statements is true?
   a) PPE will provide protection from radiological skin contamination.
   b) PPE will provide protection from penetrating radiation only.
   c) PPE will provide protection from all radiation.
   d) PPE should only be worn to protect you from other hazards.

5. _____, _____, and, _____ should be used to minimize radiation exposure.

6. Radioactive material contamination during a transportation incident usually results from _____shipping packages.

7. Which of the following is **not** a method that can be used to control the spread of contamination at an incident involving radioactive material?
   a) When entering the hot zone or potentially contaminated areas, wear personnel protective equipment.
   b) Bag or tape tools and equipment taken into the hot zone to prevent them from becoming contaminated.
   c) Allow radioactive material to continue burning to reduce the amount of contaminated material present.
   d) Limit the amount of material taken into the hot zone.

8. Two key factors to consider when determining initial isolation and evacuation distances for public protection are:
   a) the _____ of the spill, and
   b) whether or not the radioactive material is involved in a _____.

9. At an incident scene involving radioactive material, uninjured persons suspected of being contaminated should:
   a) be asked to remain in the area until surveyed by qualified personnel.
   b) be wrapped in blankets and not allowed to leave the area.
   c) be hosed down with water as soon as possible.
   d) be transported to the hospital and allowed to decay.

M E R R T T




ANSWERS

1. five
2. personal protective equipment
3. plastic bag
4. a
5. time distance shielding
6. breached
7. c
8. size fire
9. a